SECTION 17

ENVIRONMENTAL APPLICATIONS ACTIVITY AT MARSHALL SPACE FLIGHT CENTER

by

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MSFC has a history of activities in remote sensing. Many of the techniques used in the Saturn vehicles and earlier rockets involved remote detecting instruments, film cameras, television, communication equipment, and aids to data analysis. A number of these activities led to funded SR&T studies and designs. The letter from Dr. Low in November, 1970; the activity at MSFC's Mississippi Test Facility; and the 3rd Annual Earth Resources Program Review - led to a new emphasis. A new office, the Environmental Applications Office, has been established at MSFC to aid the emphasized program.

Our approach might best be summarized by mention of four points: (1) we wish to apply already-developed aerospace techniques to community problems, (2) we have not invented the problems; we have sought out potential users in the community and asked them to define problems, (3) we are applying the extensive in-house capability of our employees, and, (4) since it is a limiting factor, we have sought to apply our broad background in data management to the program.

In the short time I have, I will try to give an overall view of our activities, and to mention a few examples.

An example of SR&T oriented toward payloads for the shuttle, is the shuttle launched manned earth observatory. In this study we will define example experiments and support equipment, evaluate man's role, and develop mission requirements.

MSFC's long time role in meterology had its beginnings in problems of launch vehicles during launch and early phases of flight. This has led to a study of world-wide cloud cover as it affects ERTS and Skylab missions.

Our meterology activity also led to correlation spectroscopy as a technique for determination of atmospheric properties. This in turn led to use of similar techniques for determination of other parameters, such as correlation signatures of wet soils and snow. These parameters become inputs to hydrological models, and new data analysis methods

have resulted. Figure 1 shows a region where we are engaged in remote sensing from an airplane owned by Colorado State University. This is in the Wolf Creek Basin of Colorado -- an area already extensively instrumented for ground truth. This has also led to development of an un-supervised classification method, as reported by Smedes, et al,[1] and shown in Figure 2.

Growing out of earlier Technology Utilization work, MSFC has been engaged in a number of Environmental Applications Demonstration Projects for over a year. Emphasis has been on application of aerospace technology to community needs of Southeastern U. S. (Some of these applications fall in disciplines other than Earth Observations.) This is an incomplete list of some of these projects which are under way at the present time.

EARTH OBSERVATIONS
TYPICAL DEMONSTRATIONS PROJECTS

Hydrological Parameter Determination

Land Use Survey

Agricultural Stress Detection

New Community Site Survey

Pollution Monitoring

Urban Transportation Studies

Urban Environmental Quality

I will attempt to illustrate each of these examples.

One of the best instrumented river basins on earth is the Tennessee Valley, in which MSFC is centrally located. This has made natural several cooperative studies with TVA, University of Alabama in Huntsville, IBM, and others to apply remote sensing techniques to

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1 Smedes, H. W., Linnerud, J. J. Woolaver, L. B., Su, M. Y., and Jayros, R. R., "Mapping of Terrain by Computer Clustering Techniques Using Multispectral Scanner Data and Using Color Aerial Film." Houston, Fourth Annual Earth Resources Program Review, January 1972.

Figure 1.-Remote Sensing from Aircraft.
(Wolf Creek Basin of Colorado)

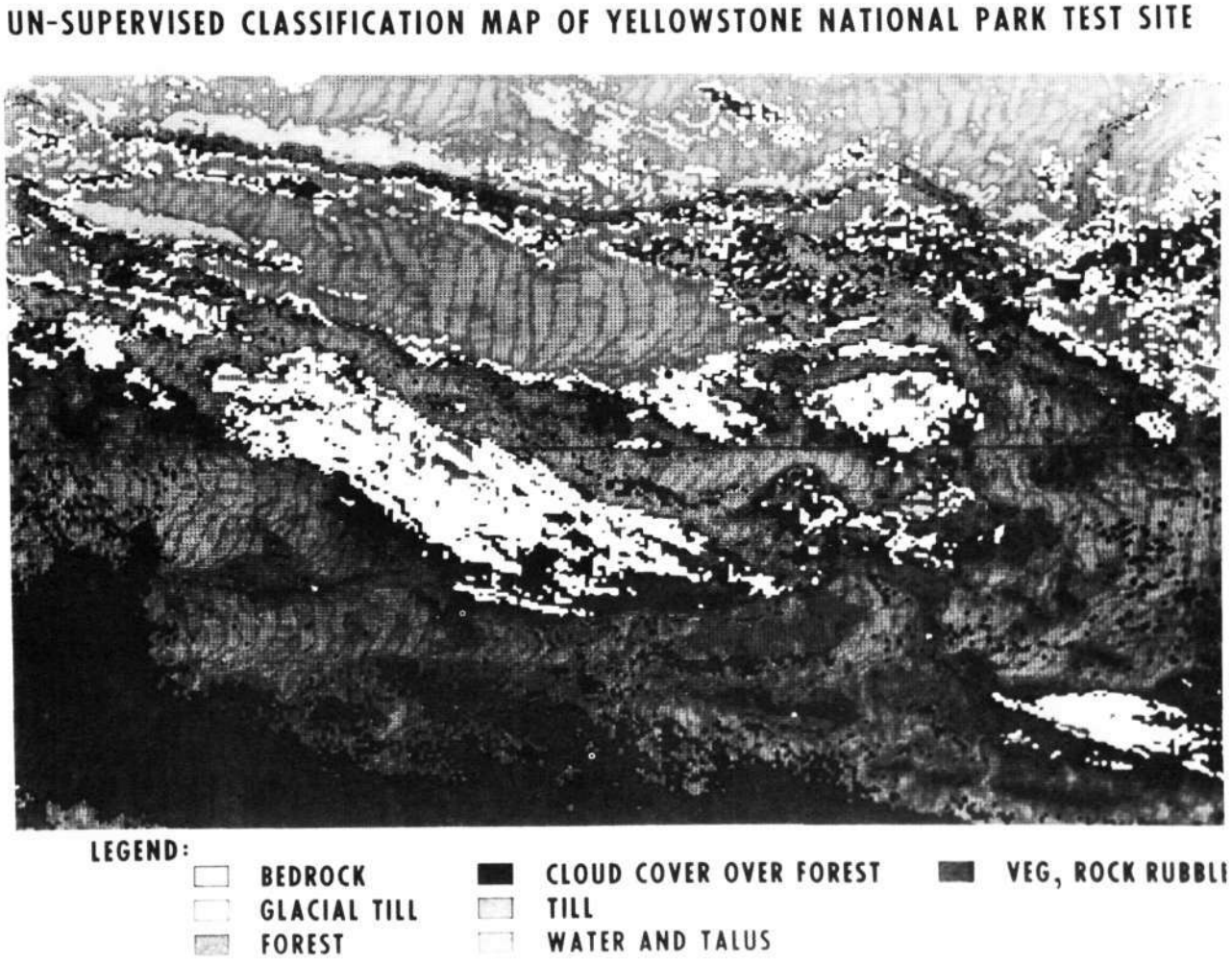

Figure 2.-Example of Un-supervised Classification Method.

determination of hydrological parameters. I have already mentioned a similar activity in Colorado.

Perhaps our most intimate local user/partner is the Top of Alabama Regional Council of Governments -- TARCOG -- five counties in Northeastern Alabama in which MSFC's main campus is located. TARCOG requested help in getting information on the most basic of planning tools - - an up-to-date study of present land-use. We had some prior experience in land-use study by means of multispectral photography, and during the past summer we collected data on the entire 10,000 km^2 area. This is now being converted into maps at the 1:24,000 scale. Ground truth support is provided by Alabama A&M University. Figure 3 shows a sample of this study. The Classification System is that growing out of the NASA/USGS June 1971 Conference.

An outgrowth of the land-use study has been study of an agricultural problem in North Alabama. Chandler Mountain, near Gadsden, has over 1,000 hectares of tomatoes, many of which are affected by nematodes. In Figure 4, the farm shown 1 lost at least $20,000 worth of tomatoes, while 7.B. , operated by a young boy using good practices, thrived.

Senator Sparkman asked us to assist HUD and the Tuskegee Alumni Housing Foundation in the study of a proposed new community site near Birmingham. Two geologists from MSFC have been conducting ground surveys, and multispectral photography has been gathered to aid in planning. Figure 5 is an index mosaic of the area. The area has scenic beauty - many rolling hills. Many of the hills turn out to be mine tailings, however, and the beautiful golden stream shown in Figure 6 is really yellow - a result of industrial pollution upstream of the site.

We are working with TVA to apply some of our Saturn instrumentation and techniques to study of air pollution.

Location of MSFC's Michoud plant in New Orleans has led to cordial relations with the planning people there. They are concerned with urban environmental quality, especially as affected by traffic. The stereo overlap on RB-57 photography results in time-lapse data of the type shown in Figure 7, which can be analysed. The amount of analysis will be large, but we have in-house research in optical processing shown in Figure 8 which is already producing results. Data taken from the Goodyear blimp before last week's Super Bowl is being analysed in this facility now.

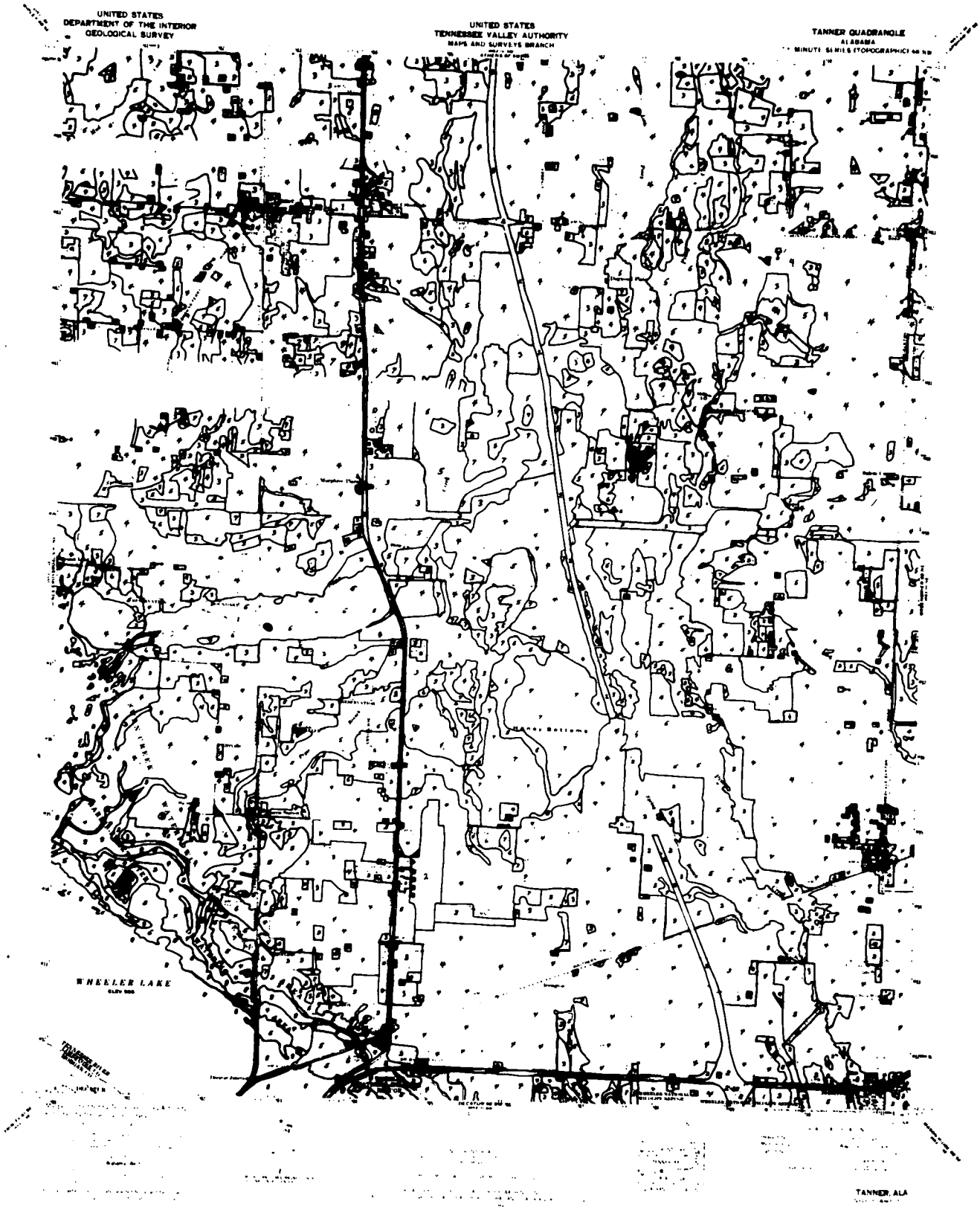

Figure 3.-Example of Land-Use Map

Figure 4.-Good and Bad Farm Practices.(Chandler Mountain)

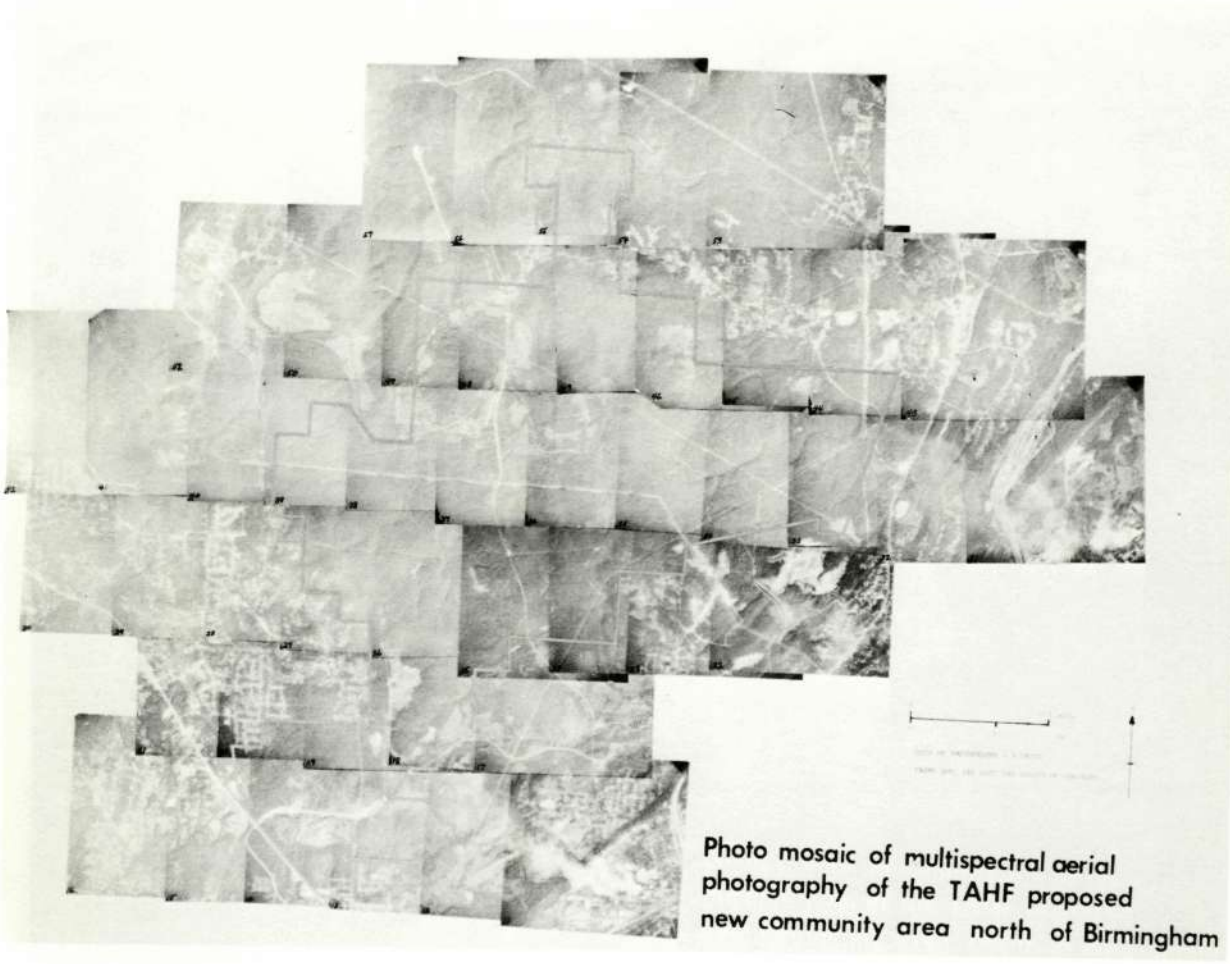

Figure 5.-Photo mosaic of North Birmingham new community site.

Figure 6.-Polluted stream in North Birmingham new community site.

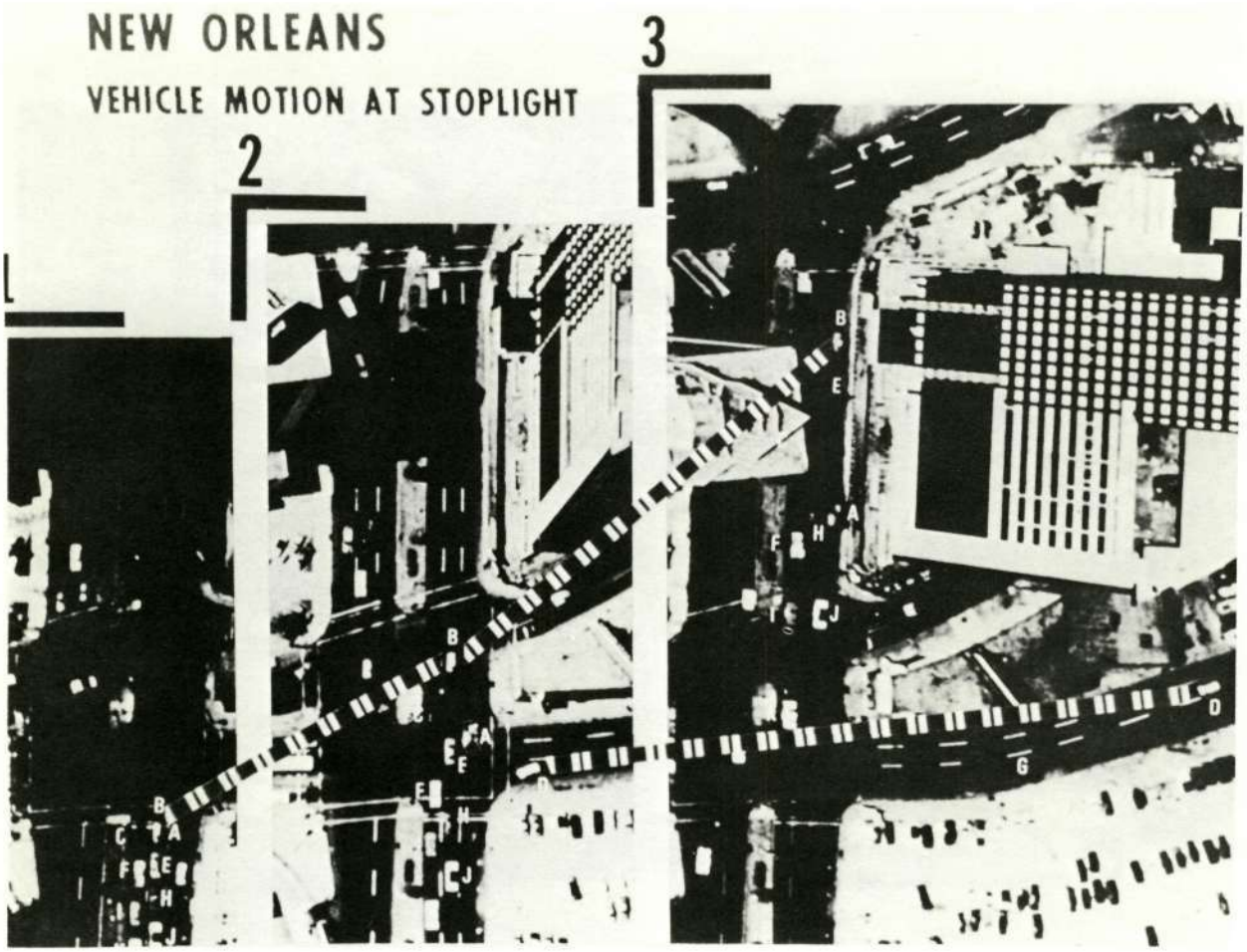

Figure 7.-Vehicle Motion at Stoplight. (New Orleans)

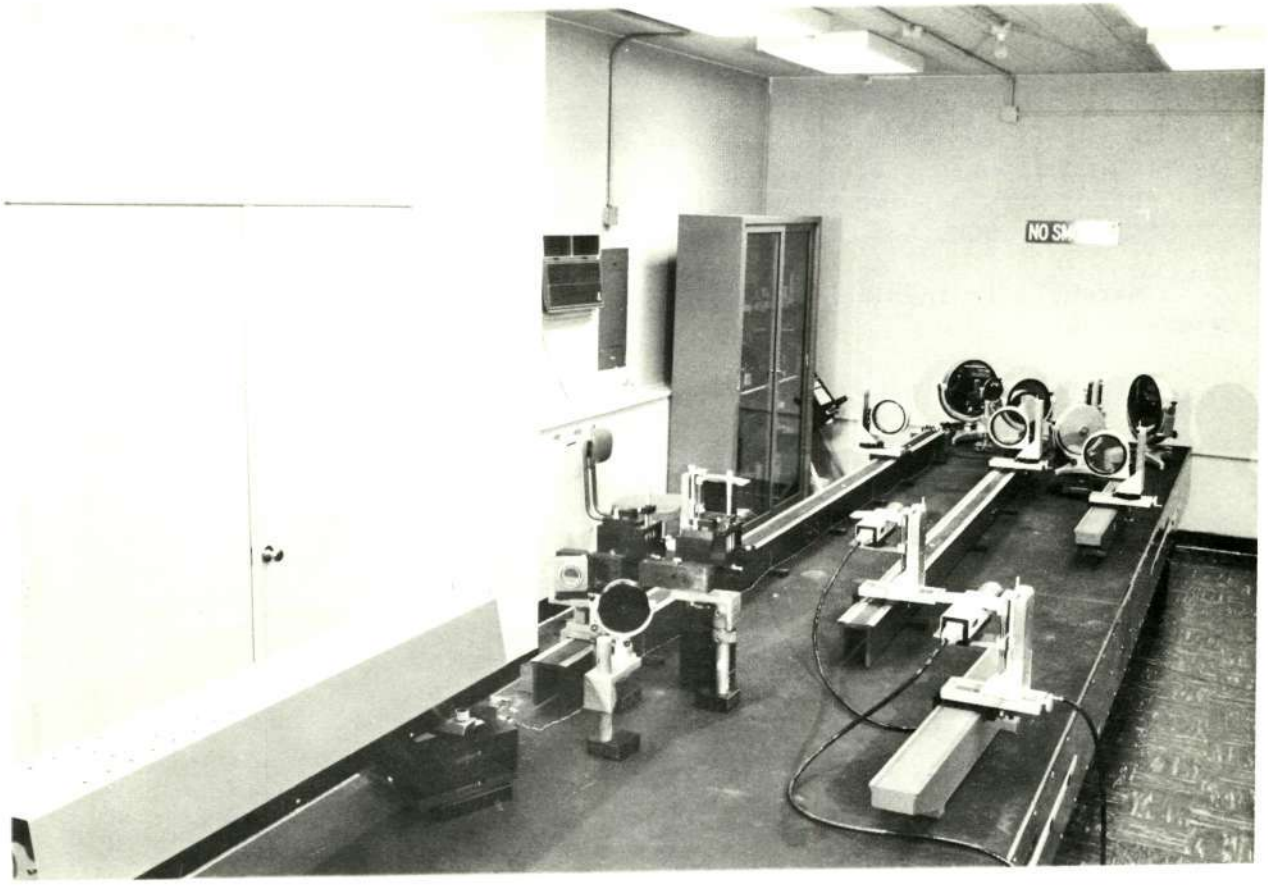

Figure 8.-Photograph of Optical Processor.

We see remote sensing from aircraft as being vital to urban problems, and expect to expand our research in this during the coming year. The City and County of Denver hopes to make remote sensing an important element in their Community Renewal Program. The entire city was imaged on Color IR film in 1969 with the help of MSC, MSFC, DOD, and others.

Marshall is involved in ERTS and Skylab EREP from a number of viewpoints:

1. Co-investigator, State of Alabama ERTS Proposal
2. Data Management Working Group
3. Scientific Monitors for ERTS
4. Data Compression Experiment for EREP
5. Proposal Evaluation Panels
6. User Identification in Southeastern States
7. Information System Studies

Marshall's Mississippi Test Facility is an important part of our involvement. It supports a number of co-located on-site activities by other agencies, and has close ties with users in the region. We consider this facility as a test bed for the long range involvement of NASA in environmental activities with other agencies of federal, state and local governments as well as an excellent model of a regional center for data analysis and dissemination. Regional modeling is a key activity at MTF and among the most interesting long range goals is the development of models of the states of Mississippi, Louisiana and Arkansas. From these models, the total impact on the region can be determined for any proposed project. Such models will be of particular utility to planning groups and to the state legislatures. The information for these models will come from the agencies located at MTF, including the NASA Earth Resources Laboratory.